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Applications of microorganism in Agriculture

**Microorganisms** play an important role in agriculture because the soil microbes (***bacteria*** and ***fungi***) are essential for decomposing organic matter and recycling old plant material. Some soil bacteria and fungi form relationships with plant roots that provide important nutrients like nitrogen or phosphorus.

Although soil organisms comprise <1% of the total mass of a soil, they have a vital role in supporting all plants and thus animals. Some of their vital functions are described below;

1. **Soil microbes break down organic matter:**Microorganisms play an important role in the decomposition of organic matter. Different types of microbes are specialised to different types of organic matter, between them covering just about everything e.g. protozoa, actinomycetes, bacteria, fungi & other saprophytic organisms.
2. **Soil microbes help to recycle nutrients:**Soil microbes play a crucial role in returning nutrients to their mineral forms, which plants can take up again. This process is known as mineralization. Nitrogen-fixing bacteria.
3. **Soil microbes create humus:**When the soil microbes have broken down all they can, what’s left is called ***humus***, a dark brown jelly-like substance that can remain unchanged in the soil for potentially millennia. ***Humus*** helps the soil retain moisture and encourages the formation of soil structure. ***Humus*** molecules are covered in negatively charged sites that bind to positively charged ions (*cations*) of plant nutrients, thus forming an important component of a soil’s cation exchange capacity. ***Humus*** is also suspected of suppressing plant diseases.
4. **Soil microbes create soil structure:**Some soil microbes secrete *polysaccharides*, *gums* and *glycoproteins*, which glue soil minerals together, forming the basis for soil structure. Fungal hyphae and plant roots further bind soil aggregates together. Soil structure is essential to good plant growth.
5. **Soil microbes fix nitrogen:**Agriculture depends heavily on the ability of certain microbes (mainly bacteria) to convert atmospheric **nitrogen** (N2 gas) to **ammonia** (NH3). Some live freely in the soil, while others live in association with plant roots the classic example is *Rhizobiumbacteria* in the roots of legumes. The process of conversion is known as **nitrogen** **fixation**. Biological nitrogen fixation contributes about 60% of the nitrogen fixed on Earth. In contrast, manufactured fertilisers contribute 25%. As the cost of energy continues to rise, so too the cost of manufactured nitrogen fertilisers will rise, so biological nitrogen fixation is likely to have ever increasing importance in food production.
6. **Soil organisms promote plant growth**: Some soil microbes produce a variety of substances that promote plant growth, including *auxins*, *gibberellins* and *antibiotics*.
7. **Soil microbes control pests and diseases:**The best-known example of the use of soil microbes in pest control is the commercial production of the soil bacterium *Bacillus* *thuringiensis* (**Bt**) to control caterpillar pests of crops. Some strains of Bt are used to control beetles and flies as well. Several strains of the fungal genus *Trichodermahave* been developed as biocontrol agents against fungal diseases of plants, mainly root diseases. Various other genera of fungi are used for the control of insect pests.